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Subject: Douglas-fir beetle/Squirrel Midden Survey, Safford RD, Coronado NF (saffordrd)

To: Forest Supervisor, Coronado National Forest

On August 18th I participated in a Pinaleno Ecosystems Restoration Project (PERP) field trip to view the effects of the Nuttall complex fires that occurred earlier that summer on the project area. During this trip I had discussions with Tom Skinner, Bob Lefevre and others regarding the potential fire effect on larger diameter Douglas-fir at squirrel midden sites and bark beetles. From these discussion and later correspondence, it was decided to further determine the potential for beetle impacts to midden sites where fire had occurred in the Nuttal complex.

On September 20th and 21st I met with the Mt. Graham Red Squirrel midden survey group to help coordinate the collection of trees scorch and site data that could be used to determine the potential susceptibility of a given midden site to bark beetle activity. This report will discuss the Douglas-fir beetle/fire interaction, methods of tree scorch and site data collection, summary of the findings and recommendations to minimize bark beetle impacts to squirrel midden sites.

Douglas-fir Beetle activity in the Pinaleno Mountains

Douglas-fir beetle (*Dendroctonus pseudotsugae*) can successfully attack trees that have been weakened by some stress. These agents of stress can be abiotic (such as drought and fire) or biotic (overstocking causing competition, diseases, insect attack, etc.). Douglas-fir beetle will breed in down trees that have been felled by wind, as well as fire-injured trees (Furness 1979, Schmitz & Gibson 1996, Ryan & Amman 1996). Where such susceptible trees are abundant, once they have been infested and killed, beetle populations can build up rapidly and spread to adjacent green, standing trees.

Douglas-fir beetle preferentially attack large, old trees in dense stands with a high Douglas-fir component. These tree and stand variable are also used in rating a stand for potential mortality (Furniss, et al. 1981, & Negron et al. 2000). The duration of Douglas-fir beetle outbreaks can be quite variable, lasting from two to several years. Those of longest duration coincide with periods of drought.

Douglas-fir beetle has one generation per year. Broods remain in the tree and overwinter mainly as adult beetles, but also as larvae. Initial adult flights vary from year to year with location and weather, but most new attacks take place in mid-to-late spring. Larvae that have overwintered complete their development and emerge as adults in the summer. Typically, late-season attacks account for less than 20 percent of all attacks in one season.

Douglas-fir beetle activity in the Pinaleno Mountains has been at low to moderate levels over the past several years. Scattered small pockets of tree mortality have been detected by aerial and ground surveys over that same time.

Survey Methods and Results

Scorched Douglas-fir are very susceptible to Douglas-fir beetle attack. This has been well documented in the literature and predicative models have been developed for determining tree mortality related to fire damage and subsequent beetle attack (Peterson & Arbaugh 1986, Flanagan 1996, Furniss 1965 and others). Hood et al. found that Douglas-fir 14 inches dbh and greater with crown scorch greater than 30 percent of the total live crown would have a moderate to high probability of being attached by Douglas-fir beetle within 2 years. The Hood et al. findings were used to rate midden sites in the Pinaleno Mountains as to the probability of future beetle activity.

The survey methods for the squirrel midden sites focused on a tally of all Douglas-fir within a 50 foot radius of the midden that had some level of fire activity on the site. Data collected included: squirrel midden number, Douglas-fir dbh and Douglas-fir percent crown scorch. Diameter and crown scorch were recorded in categories; dbh (11-15.9", 16-21.9" and >22") and % crown scorch (0-33%, 34-66% and > 66%), Figure 1.

Figure 1. Crown scorch caused by the Nuttal complex fires in the Pinaleno mountains, Safford RD, Coronado NF. Percent crown scorch was used to determine Douglas-fir susceptibility to Douglas-fir beetle attack..

There were 61 squirrel midden sites surveyed for Douglas-fir crown scorch. At 20 of those sites there was no fire activity or very little crown scorch recorded. Eighteen sites were rated as having a low susceptibility level, 13 sites in the moderate level, and 10 sites at the high level, Table 1. The literature suggests and my experience supports, that larger diameter Douglas-fir with crown scorch greater than 30-50% have roughly an 80-90% chance of being attacked by Douglas-fir beetle. All the moderate to high susceptibility rating sites will most likely experience some level of beetle activity over the next 2-3 years with most of the larger diameter trees being attacked. The low susceptibility sites could also experience beetle related tree mortality, however at a lesser extent. This could change if an outbreak were to occur.

Table 1. Midden sites surveyed with corresponding Douglas-fir beetle susceptibility rating. The susceptibility rating is as follows; (**none**) represents no D-fir on site with fire damage, (**low**) is represented by 3 or more D-fir w/ less than 33% crown scorch (CS) & no more that 2 D-fir >22: dbh, (**moderate**) is represented by 3 or more D-fir w/ 34-66% CS, or 3 or more D-fir >22" dbh w/ up to 33% CS, (**high**) is represented by 2 or more D-fir with > 66% CS.

Midden Number	# of trees surveyed	D-fir Beetle Susceptibility Rating			
CF-108	3		Low		
CF- 06	2		Low		
CF- 68	5				High
CF- 24	7		Low		
CF- 14	7				High
CF- 48	2	None			
CF- 61	4	None			
CF- 13		None			
CF- 115		None			
CF- 12		None			
MP- 65	7				High
MP- 141	5				High
MP- 40	2	None			
MP- 54	4		Low		
MP- 112	9			Mod	
MP- 113	6				High
MP- 64	6				High
MP- 140	7				High
MP- 116	5		Low		
MP- 170	9			Mod	
MP- 118	2	None			
MP- 131	6			Mod	
MP- 62	6		Low		
MP- 57	4			Mod	
MP- 120	4			Mod	
MP- 58	7	None			
MP- 61	4	None			
MP- 53	5		Low		
MP- 41	6			Mod	
MP-New 99	5		Low		
MP- 77	3		Low		
MP- 48	1	None			
MP- 47	6		Low		
MP- 111	5		Low		
MP- 121	3	None			
MP- 110	3	None			
MP-108	4	None			
MP- 109	8			Mod	
MP- 132	3		Low		
MP- 59	10			Mod	
MP- 133	9				High
MP- 123	5			Mod	
MP- 124	8				High
MP- 125	4			Mod	
PV- 21	1	None			
WP- 46	10				High
WP- 122	1	None			
WP- 138	2	None			
WP- 243	4		Low		
BC- 85	3		Low		
BC- 75	6		Low		
BC- 55	7	None			
BC- 03	1	None			
BC- 113	2			Mod	
TF- 07	6		Low		

TF- 25	8		Low		
TF- 05	17			Mod	
TF- 40	15			Mod	
TF- 52	17		Low		
CO- 79	4	None			
CO- 43	7	None			

CF - Chesley Flat BC- Bible Camp
MP - Merrill Peak TF- Turkey Flat
WP - Webb Peak CO-

Recommendations

To take a proactive approach and minimize future spread of this beetle in and around susceptible midden sites, I recommend the deployment of the anti-aggregation pheromone for Douglas-fir beetle. The anti-aggregation pheromone (3-methylcyclohex-2-en-1-one[[MCH]) serves to disrupt aggregation behavior of beetles (Schmitz and Gibson, 1996). MCH is being used operationally and successfully on the Apache-Sitgreaves, Coconino and Coronado NF to protect localized areas from being attacked by Douglas-fir and Spruce beetle.

At a minimum I suggest deploying MCH on 2-4 acres around each moderate and high susceptible site at a rate of 40 capsules per acre. The bubble capsules are stapled on the south side of trees on an evenly spaced grid pattern throughout the treatment area (Ross, et al., 2001). An alternative and more aggressive approach would be to treat larger areas that would encompass multiple midden sites. This strategy would potentially protect a larger area around and between midden sites. There is an additional cost and time commitment to deploy the material with this approach. At each low susceptible site an individual tree protection strategy is recommended. This would require stapling 4 MCH capsules on all larger diameter (D-fir greater than 16" dbh), crown scorched Douglas-fir within a 100 foot radius of the midden site. The treatment area should be monitored in late summer to determine effectiveness and determine is additional treatments are warranted. The post treatment monitoring can be done in conjunction with the fall midden survey. MCH treatments may be needed for 2-4 years after the fire depending on beetle activity adjacent to the treatment sites.

Funds may be available from Forest Health Protection to deal with the Douglas-fir beetle situation. If you have any questions regarding this assessment of the potential beetle activity related to scorch Douglas-fir trees adjacent to the midden sites surveyed or the recommendations given, please let us know. I can be reached at (928) 556-2073.

/s/ John Anhold
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cc: Randall A Smith, Melinda D Roth, Robert Lefevre, Lisa Angle, Thomas Skinner, Anne Casey, Leonard Lucero, Debra Allen-Reid

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